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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/586,624	06/02/2000	Naoya Hasegawa	9281/3660	6578

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EXAMINER	
BERNATZ, KEVIN M	

ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 03/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/586,624	HASEGAWA, NAOYA	
	Examiner	Art Unit	
	Kevin M Bernatz	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-14 is/are pending in the application.

4a) Of the above claim(s) 10-14 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-9 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Response to Amendment

1. Amendments to claims 1 and 9, filed on December 18, 2003, have been entered in the above-identified application.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Applicants have requested evidentiary art to support the Examiner's position that the thickness of a layer between two magnetic layers can be adjusted to control the exchange coupling force between the two magnetic layers. The Examiner has supplied several references for applicants and has included them in the basis of the rejection, though the grounds of the rejection has not changed, i.e. Tanaka et al. (U.S. Patent No. 5,420,833), Ohyama et al. (U.S. Patent No. 5,699,213) and Soeya et al. (JP 05-135331 A).

Claim Rejections - 35 USC § 103

4. Claims 1, 2, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent No. 6,074,767) in view of Gill et al. (U.S. Patent No. 5,508,866), Rottmayer et al. (U.S. Patent No. 6,201,673), Tanaka et al. (U.S. Patent No. 5,420,833), Ohyama et al. (U.S. Patent No. 5,699,213) and Soeya et al. (JP 05-135331 A). See provided JPO and Machine Translation of JP '331 A.

Regarding claims 1 and 2, Lin discloses a spin-valve magnetoresistive (MR) sensor comprising, on a substrate (*Figure 3, element 17*), an antiferromagnetic layer (*element AFM_1*), a pinned magnetic layer formed in contact with said antiferromagnetic layer (*element 32*) and having a magnetization direction made stationary under an exchange anisotropic magnetic field generated by interaction with said antiferromagnetic layer (*col. 5, lines 54 – 58*), a non-magnetic electrically conductive layer (*element 35*) formed between a free magnetic layer (*element 36*) and said pinned magnetic layer, soft magnetic layers (*elements 41*) arranged on said free magnetic layer, bias layers (*elements AFM_2*) formed on said soft magnetic layers to uniformly arrange a magnetization direction of said free magnetic layer in a direction crossing the magnetization direction of said pinned magnetic layer (*col. 5, lines 63 – 66; col. 6, lines 50 – 54; col. 6, line 65 bridging col. 7, line 2*), and electrically conductive layers (*element 43*) formed on the bias layers to apply a detection electric current to said free magnetic layer (*intended use limitation, but see col. 7, lines 3 – 5*), wherein said antiferromagnetic layer (AFM_1) and bias layers (AFM_2) each comprising an alloy containing Mn and at least one element selected from the group consisting of Pt, Pd, Rh, Ru, Ir, Os, Au, Ag, Cr, Ni, Ne, Ar, Xe, and Kr (*col. 5, lines 59 – 62 and col. 6, lines 45 – 50*). See also Lin, col. 5, line 26 bridging col. 7, line 38 for the entire description of Figure 3.

Regarding the limitation "having a spacing between said soft magnetic layers corresponding to a track width defined at a level at which said soft magnetic layers fill recesses in the free magnetic layer", this limitation is deemed to be necessarily met by the prior art since the prior art is substantially identical in structure, specifically a free

layer with two spatially distinct biasing layers on the ends of the free layer (*Lin, elements AFM_2*). The examiner's sound basis for this assertion is that Gill et al. explicitly teach that the track width is known to be defined by the distance between the two spaced-apart end regions in a MR sensor (*Gill et al., Figure 7, elements 76; and col. 8, lines 4 – 8*).

Lin fails to disclose the limitation "wherein a thickness of said soft magnetic layers exceeds a depth of the recesses".

However, the Examiner deems that the thickness of the soft magnetic layers (*elements 41*) can be varied to effect the exchange coupling interaction between the AFM bias layers (*Lin, "AFM_2" layers*) and the free layer (*Lin, layer 36*) in a magnetic sensor, since the coupling force depends on the relative "closeness" of the two layers (*see Ohyama et al., Description of Background Art; Tanaka et al. – col. 6, lines 18 – 45 and examples 2, 4, 5, and claim 2; Soeya et al. – Figure 7 and Machine Translation, Paragraphs 0004, 0014, 0068, 0073, 0082, 0083 and 0113*). Furthermore, Gill et al. provides evidence that the thickness of the soft magnetic layers between the free magnetic layer and the antiferromagnetic layer can exceed the depth of the recess, including a thickness up to the height of the non-magnetic cap layer (*Figure 7, layers 74 and col. 7, line 37 bridging col. 8, line 14*). Therefore, the Examiner deems that it would have been obvious to one having ordinary skill in the art to determine an optimal relative thickness of the soft magnetic layers under the antiferromagnetic layers by optimizing the results effective variable through routine experimentation. *In re Boesch*, 205 USPQ

215 (CCPA 1980); *In re Geisler*, 116 F. 3d 1465, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997); *In re Aller*, 220 F.2d, 454, 456, 105 USPQ 233, 235 (CCPA 1955).

None of the above disclose a free magnetic layer comprising a first free magnetic layer, a second free magnetic layer and a non-magnetic layer interposed between them, nor the magnetization directions of the first and second magnetic layers.

However, Rottmayer et al. teach that it is old in the art to use a "synthetic free magnetic layer" comprising a free magnetic layer meeting applicant's claimed structural limitations inorder to maintain a high magnetoresistance and allow for higher reading densities (*col. 1, lines 54 – 67*). Rottmayer et al. further disclose that the magnetization directions are in directions 180° different from each other (*col. 4, lines 5 – 8 and Figure 1B*).

Regarding claim 7, Lin discloses the soft magnetic layers as being preferably NiFe (*col. 6, lines 34 - 35*).

Regarding claim 8, Lin discloses a free magnetic layer meeting applicant's claimed limitations (*Figure 3, recesses are the regions where element 41 is deposited*).

5. Claims 3 - 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin ('767) in view of Gill et al. ('866), Rottmayer et al. ('673), Tanaka et al. ('833), Ohyama et al. ('213) and Soeya et al. (JP '331 A) as applied above, and further in view of Kishi et al. (U.S. Patent No. 6,007,643).

Lin ('767), Gill et al. ('866), Rottmayer et al. ('673), Tanaka et al. ('833), Ohyama et al. ('213) and Soeya et al. (JP '331 A) are relied upon as described above.

Regarding claims 3 and 4, none of the above explicitly disclose a Mn-X alloy meeting applicant's claimed composition limitations.

However, Lin teaches Mn alloys as suitable alloys for the various anti-ferromagnetic layers (*col. 5, lines 59 – 62 and col. 6, lines 45 – 50*) though Lin fails to explicitly teach that these are equimolar compositions.

However, Kishi et al. teach that the amount of Mn and non-Mn elements and can be varied to effect the magnetic properties of the antiferromagnetic films in a magnetic sensor (*Figures 8 and 9*). Therefore, the Examiner deems that it would have been obvious to one having ordinary skill in the art to determine an amount of Mn in the Mn alloy meeting applicant's claimed composition limitation by optimizing the results effective variable through routine experimentation.

Regarding claims 5 and 6, Kishi et al. teach PtMn-X alloys meeting applicant's claimed composition limitations as good antiferromagnetic layers in MR sensors since they possess superior corrosion resistance (*col. 2, lines 48 – 62; col. 3, line 56 bridging col. 4, line 20; claim 1; and Figures 8 and 9*). It would therefore have been obvious to one of ordinary skill in the art at the time of the applicants' invention to modify the device of Lin ('767) in view of Gill et al. ('866), Rottmayer et al. ('673), Tanaka et al. ('833), Ohyama et al. ('213) and Soeya et al. (JP '331 A) to use a PtMn-X antiferromagnetic composition as taught by Kishi et al. inorder to form antiferromagnetic layers possessing superior corrosion resistance.

6. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin ('767) in view of Gill et al. ('866), Rottmayer et al. ('673), Tanaka et al. ('833), Ohyama et al. ('213) and Soeya et al. (JP '331 A) as applied above, and further in view of applicant's admissions.

Regarding claim 9, Lin ('767), Gill et al. ('866), Rottmayer et al. ('673), Tanaka et al. ('833), Ohyama et al. ('213) and Soeya et al. (JP '331 A) are relied upon as described above.

None of the above explicitly teach controlling the thickness values of the two free magnetic layers in a "synthetic" free magnetic layer to meet applicants' claimed thickness limitations. The Examiner notes that Rottmayer et al. does teach that the thickness of each layer can be optimized to control the relative magnetic moments and the mean free path of the electrons (*col. 1, line 62 bridging col. 2, line 9; col. 4, lines 15 – 23*).

However, applicant admits that it is old in the art to form a synthetic free magnetic layer where the relative magnetic moments can be optimized by controlling the thickness of the layers to meet applicant's claimed relative thickness limitations (*specification, page 9, line 6 bridging page 11, line 5*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant's invention to modify the device of Lin in view of Gill et al., Rottmayer et al., Tanaka et al., Ohyama et al. and Soeya et al. to use a synthetic free magnetic layer meeting applicant's claimed structural and thickness limitations as admitted by applicant inorder to maintain a high magnetoresistance and allow for higher reading densities.

Response to Arguments

7. The rejection of claims 1 - 9 under 35 U.S.C § 103(a) – Lin in view of Gill et al. and various references

Applicant(s) argue(s) that with respect to the thickness of the soft magnetic layer, Gill et al. Figure 7 is ambiguous and cannot be relied upon. The examiner respectfully disagrees.

The Examiner notes that the ambiguity is with the final height of the soft magnetic layer and whether it is equal to or lower than the Ta cap layer. There does not appear to be any ambiguity with regard to the fact that the soft magnetic layer exceeds the height of the free layer (*layer 75*).

Applicants further argue that the thickness of the soft magnetic layer is critical for many reasons and that since applicants' are using the soft magnetic layers for a different purpose than Gill, the teaching in Gill does not recognize these improvements. The Examiner respectfully disagrees.

An invention may be obvious if the prior art has different reasons for doing what the applicant has done. "It has long been held that a rejection under 35 USC 103 based upon a combination of references is not deficient solely because the references are combined based upon a reason or technical consideration which is different from that which resulted in the claimed invention." *Ex parte Raychem Corp.* 17 USPQ 2d 1417, 1424 (BPAI 1990). Cites *In re Kronig* 190 USPQ 425 (CCPA 1976); *In re Gershon* 152 USPQ 602 (CCPA 1967). The Examiner notes that while applicants' arguments have

been considered, if applicants are alleging unexpected results based upon such a structure a declaration or affidavit detailing the unexpected results should be submitted as evidence. Presently there is no evidence of record supporting a position of unexpected results.

Finally, applicants state that there is no support for the Examiner's position that the thickness of the soft magnetic layers can be adjusted to control the exchange coupling between the bias layers and the free layer, nor that the track width is equal to the spacing between the soft magnetic layers. The Examiner respectfully disagrees.

The Examiner has clarified the rejection of record to cite prior art confirming the Examiner's position. Specifically, Ohyama et al. ('213) deal with the problem of the exchange coupling force between a MR film and an antiferromagnetic film and mention that Soeya et al. (JP '331 A) attempt to address the problem by providing a ferromagnetic film between the MR film and the antiferromagnetic film in a proscribed thickness and composition, and that the thickness of the ferromagnetic film is adjusted to control the exchange coupling (*col. 1, lines 28 – 48*). Tanaka et al., while directed to a magneto-optical recording media, is deemed analogous art since it teaches the underlying physics. Specifically, as a magnetic, non-magnetic or weakly magnetic intermediate layer is made thicker, the exchange coupling forces between two magnetic layers on each side of the intermediate layer becomes smaller (*col. 6, lines 18 – 45 and examples*). Regarding the limitation in the track width, as noted in the previous rejection Gill et al. explicitly teach that the track width is equal to the spacing between the bias layers (and hence, the soft magnetic layers directly underneath the bias layers).

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on (571) 272-1516. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB
February 26, 2004

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